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TRENDS IN CONSUMPTION AND PRICES OF BUILDING MATERIALS

BY

OLIVER BOWLES AND NAN C. JENSEN

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

TRENDS IN CONSUMPTION AND PRICES OF BUILDING MATERIALS[1]

By Oliver Bowles[2] and Nan C. Jensen[3]

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INTRODUCTION

The inorganic nonmetallics - that is, all minerals and their primary products except metallic ores and fuels - have an important place in the industrial life of any country. They are essential to a multitude of products and processes, and their development is closely related to general industrial activity. Several are classed as strategic, and many others are performing necessary functions in the military program. It may be of interest therefore to trace their history over a period of years and to correlate their progress with the circumstances and events that are shaping national history. To this end, consumption and prices of the important group of building materials, beginning with 1910, have been tabulated herein, and an attempt has been made to correlate the figures with passing events. The Bureau of Mines has made one study[4] of this subject, including data up to 1932, and the ensuing 10 eventful years furnish an additional background upon which to base conclusions of great import to the industries concerned.

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[1] This paper is the first of a series on trends in consumption and prices of nonmetallic minerals. The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7265."
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The momentous 33 years from 1910 to 1942, for which statistics are presented herein, embraced first the conclusion of a long period of relatively uneventful peace followed by a 4-year world war. A brief postwar depression was followed by a period of unprecedented prosperity and then by an era of world-wide depression during which industry was virtually stagnant. The country was emerging slowly from this quagmire of industrial inactivity when a second world war provided an enormous artificial stimulus to production that had reached peak intensity at the end of the period covered by this report. Within this third of a century America has experienced more violent fluctuations from peace to war, from prosperity to adversity, and vice versa, than in any like time in the nation's history. It is profitable therefore to follow the trends in prices and consumption of various groups of nonmetallic minerals as affected by these swiftly changing forces. In the following tables and text devoted to individual commodities reasons for advancement or retardation, as the case may be, are discussed. The history of consumption and prices for a third of a century presented herein may afford some basis for presaging and evaluating future trends and planning postwar adjustments.

GENERAL DEVELOPMENT

The growth of the nonmetallic mineral industries, on the basis of value, from their inception until 1931 has been covered in a previous report.[5] The value of output of nonmetallic minerals produced in the United States in 1880 was only about $56,000,000; by 1910 it had grown to $410,000,000, and in 1942 it was $1,123,100,000. The present study is based both on quantities and values.

Nonmetallic minerals comprise several closely related groups, including building materials (cement, stone, sand and gravel, slate, lime, and gypsum); chemical raw materials (salt, salines, barite, sulfur, and lime); ceramic raw materials (kaolin, feldspar, and flint); fertilizer materials (phosphate rock, potash, and nitrates); abrasive materials (garnet, emery, sand, diatomite, and tripoli); refractories (fire clay, magnesite, dolomite, and ganister); and a miscellaneous group, some of which have highly specialized uses. The latter classification includes asbestos, mica, and talc.

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[4] Tyler, Paul M., Consumption and Prices of Nonmetallic Minerals: Bureau of Mines Inf. Circ. 6794, 1934, 50 pp.

[5] Bowles, Oliver, and Justice, C. W., Growth and Development of the Nonmetallic Mineral Industries: Bureau of Mines Inf. Circ. 6689, 1933, 49 pp.

The rate of growth has varied greatly with different commodities. The substantial expansion in output that has characterized most of them since 1910 has been linked to enlarged industrial activity, invention, changing fashions, and development of new products and processes. Growth of demand for low-priced large-tonnage commodities like crushed stone, sand, gravel, and cement has, in general, paralleled the volume of construction. The automobile age brought about a vast expansion in the output of cement and aggregates for the construction of a network of highways; therefore, figuratively, cars consumed cement, stone, and gravel as well as gasoline.

The output of fluxing limestone and refractories expanded with increasing activity in the iron and steel industries. Substantial gains in the use of electrical equipment and the phenomenal development of radio stimulated the consumption of mica. Wide expansion in chemical-processing industries created increasing demands for such chemical raw materials as sulfur, lime, and salt. On the other hand, the use of substitute products retarded the growth of certain nonmetallics, notably building lime, roofing slate, and natural abrasives.

PROSPECTS

The future of certain nonmetallics can be forecast with some degree of assurance; that of others is more problematical. Unless the Nation is plunged into a disastrous postwar depression, which all planners are seeking to avoid, the great group of building materials may expect reasonable stability in view of the extensive anticipated program of building, highway construction, and public works. The demand for chemical raw materials is likewise expected to be strong, but the future of the nonmetals that have more highly specialized application hinges upon new inventions, changed processes, and expanded uses. Just as radio communication has created growing needs for high-grade mica and ceramic talc and the trend from riveting to welding has led to wider use of rutile and amphibole asbestos as welding-rod coatings, so may television, household cooling systems, and many innovations at present with no more substance than a dream, create new and strange uses for nonmetallic minerals during the years to come.

BUILDING MATERIALS

The nonmetallics industries are so broad and diversified that in this series the commodities comprising them will be considered in more or less related groups. The present report discusses the major building materials - the most important segment as regards tonnage and general use. The volume of production of the commodities considered herein (cement, crushed stone, sand and gravel, building stone, roofing slate, building lime, and gypsum) in 1942 exceeded 470,000,000 tons, and the value at the point of production was more than $612,000,000. The value at the point of consumption would of course be very much greater. The values given herein represent the actual realizations as reported by producers f. o. b. quarry or mill.

Statistics on heavy-clay products, such as brick and tile, have been compiled for many years by the Bureau of the Census. These products have not been included in this discussion because information for the years since 1937 is incomplete, and in some instances the classifications and data are not comparable from year to year.

As an aid in visualizing annual gains or losses in consumption or prices, columns of index numbers have been included in each of the major tables. The average of 1935 to 1939 is now generally accepted as a standard basis for comparison, and the index numbers presented herein are percentages of this average.

CEMENT

Consumption. - The growth of the cement industry since 1910 was linked with three far-reaching movements in our national life - reinforced-concrete construction, used extensively for large buildings; intensive highway building, which was concomitant with the automobile age; and the construction of massive dams and other structures connected with reclamation projects and other public works. Supplementing these major applications, innumerable uses were found for cement which carried it to virtually every farm and every city habitation in the nation.

Cement production was an important industry as far back as 1910, when annual sales exceeded 75,000,000 barrels, but it experienced little further growth until a few years after the close of the World War of 1914-18. At that time, all three of the major cement-consuming activities - the erection of reinforced-concrete buildings, highway construction, and public works projects - began to make rapid gains, and by 1928 consumption had reached almost 180,000,000 barrels a year. During the depression of 1932 to 1935, when all types of construction had reached a low ebb, the cement industry suffered a severe decline because cement and construction are complementary.

The effects of the two great world wars on the cement industry have been strikingly different. The conflict of 1914-18 was essentially a war of men and guns, in which airplanes and tanks played relatively minor roles. Construction of small, scattered airfields and the relatively few new munition factories that characterized this earlier war consumed such limited quantities of cement that no stimulation of the industry was apparent for that period. The present World War is a mechanized struggle in which airplanes, tanks, ships, and mobile artillery predominate. To construct numerous large airfields, fortifications, munition plants, and shipyards, enormous quantities of cement have been needed, and consumption has advanced to unprecedented levels. This is the more remarkable in view of the drop to an extremely low point, particularly in 1942, of all types of peacetime construction.

Prices. - Factory prices for cement have not varied greatly. Aside from the abnormally high price of 1920 and the low levels of the depression period, they have shown only moderate fluctuations for the past 25 years. The relation of price levels to cost of manufacture is of special interest. Certain elements that have tended to increase the cost of production are : (1) Exhaustion of the more readily available raw materials requiring deeper quarrying, underground mining, and in some operations longer haul; and (2) demands for special cements and increasing rigidity of specifications which call for special preparation of raw materials, close control both of composition and calcination, and finer grinding. The higher cost elements outlined above are offset by important economies that have been perfected, namely: (1) Increased mechanization, which has led to a larger and larger output per man-hour, and (2) a striking increase in fuel efficiency. These opposing elements so nearly balance that prices for the past 9 years have fallen within the narrow range of \$1.45 and \$1.54 per barrel, with an average of \$1.49.

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Cement

Year	Domestic shipments				Net exports (-) or imports (+) (barrels)	Apparent consumption	
	Barrels	Value				Barrels	Index nos. 1935-39 ave. = 100
		Total	Average per barrel	Price index nos. 1935-39, ave. = 100			
1910	1/77,785,141	1/$68,752,092	$0.88	59	-2,169,094	75,616,047	69
1911	1/79,547,958	1/ 66,705,136	.84	57	-2,970,739	76,577,219	70
1912	85,925,651	69,554,385	.81	55	-4,147,029	81,778,622	75
1913	89,541,348	89,550,527	1.00	68	-2,878,888	86,662,460	80
1914	87,257,552	80,533,203	.92	62	-2,019,291	85,238,261	78
1915	87,685,222	75,155,102	.86	58	-2,522,813	85,162,409	78
1916	95,394,433	104,689,090	1.10	74	-2,562,140	92,832,293	85
1917	91,342,930	123,210,458	1.35	91	-2,583,892	88,759,038	81
1918	71,348,474	113,717,616	1.59	107	-2,252,141	69,096,333	63
1919	86,141,488	147,318,398	1.71	116	-2,454,642	83,686,846	77
1920	97,079,200	195,589,915	2.01	136	-2,461,203	94,617,997	87
1921	96,046,549	181,675,440	1.89	128	-1,058,697	94,987,852	87
1922	118,590,644	208,464,028	1.76	119	- 771,914	117,818,730	108
1923	137,183,792	259,631,776	1.89	128	+ 765,576	137,949,368	127
1924	147,466,010	266,053,267	1.80	122	+1,145,120	148,611,130	136
1925	159,046,937	281,075,691	1.77	120	+2,647,861	161,694,798	148
1926	164,218,941	280,785,583	1.71	116	+2,269,897	166,488,838	153
1927	174,023,051	281,735,676	1.62	109	+1,249,004	175,272,055	161
1928	178,051,977	278,883,042	1.57	106	+1,477,819	179,529,796	165
1929	172,027,452	255,104,506	1.48	100	+ 860,024	172,887,476	159
1930	160,846,350	231,249,287	1.44	97	+ 229,029	161,075,379	148
1931	128,377,384	142,579,826	1.11	75	+ 39,945	128,417,329	118
1932	81,368,031	82,718,197	1.02	70	+ 93,558	81,461,589	75
1933	64,760,517	86,228,666	1.33	90	- 203,114	64,557,403	59
1934	76,579,483	117,881,816	1.54	104	- 300,174	76,279,309	70
1935	76,244,328	114,809,724	1.51	102	+ 203,305	76,447,633	70
1936	114,610,972	172,777,698	1.51	102	+1,324,229	115,935,201	106
1937	115,678,182	171,414,093	1.48	100	+1,425,378	117,103,560	107
1938	108,192,076	156,703,002	1.45	98	+1,169,185	109,361,261	100
1939	125,056,594	184,254,932	1.47	99	+ 767,514	125,824,108	116
1940	132,864,383	193,464,869	1.46	99	-1,129,535	131,734,848	121
1941	170,365,440	250,589,481	1.47	99	2/-1,714,062	3/168,651,378	155
1942	187,809,208	286,905,197	1.53	103	(4/)	5/187,809,208	172

1/ Domestic production. 2/ January to September, inclusive.
3/ Includes imports and exports for the first 9 months only. 4/ Data not available.
5/ Domestic shipments. Data on imports and exports not available.

CRUSHED STONE

Consumption. - The crushed-stone industry experienced little growth from 1910 until 4 years after the first World War. That war did not stimulate the production of aggregates because, as pointed out in the discussion of the cement industry, the type of warfare made limited demands on concrete construction. During the prosperous postwar era of highway and building construction up to 1929 the industry grew rapidly, and consumption in 1927 reached a level nearly 2-1/2 times as high as in 1917. During the depression years the output declined considerably but was sustained to some extent by make-work projects sponsored by the Works Progress Administration, Civilian Conservation Corps, and other Government agencies. The striking recovery of the industry in 1936 and its expansion during following years up to 1940 were due in large measure to various State and Federal Government-controlled enterprises which were designed at first to relieve unemployment and were replaced later by national defense activities. During these years the noncommercial output comprised 30 to 40 percent of the total.

In 1941 and 1942 consumption reached an all-time high record, for although private construction was greatly reduced such losses were more than compensated by the enormous demands for aggregates used in concrete construction for airfields, highways, factories, fortifications, shipyards, and other military establishments. Furthermore demands for railroad ballast were greatly enlarged to maintain overburdened roadbeds.

Prices. - Prices of crushed stone were stabilized at about 60 cents a ton until the inflationary period at the close of the World War of 1914-18, when they increased and reached an all-time high of $1.26 a ton in 1920, the year of runaway commodity prices. From 1922 to 1930 they ranged from $1.01 to $1.09, and thereafter the average selling price generally kept between 90 cents and $1.00 a ton.

A comparison of commercial and noncommercial average values is of special interest. The accompanying table shows such figures, beginning with 1933, the first year for which separate data are available. Except for 1934 and 1935, the unit values of noncommercial stone were consistently and generally substantially higher than those of the commercial product. This condition is the reverse of that in the sand and gravel industry, in which noncommercial prices are substantially lower than prices received by commercial companies, as discussed in the section devoted to the sand and gravel industry. In the latter, lack of preparation accounted in large measure for the lower price, but in the stone industry few short cuts from quarry to project are possible. Drilling, blasting, crushing, and screening are necessary steps before the product is ready for use. Thus the noncommercial product must in general pass through the same stages of preparation as commercial stone, and production costs in the two types of operations should presumably be about equal.

Various reasons may be assigned for the high cost of stone produced at Government-sponsored plants. Some projects are of short duration, and the cost of establishing and equipping quarries must be charged against a low total output. In other projects, high costs may be charged to the inexperience of the organizations, to the use of untrained workers, to overmanning, or to inadequate equipment and methods. Instances are known of municipally operated quarries having produced stone at costs higher than $4.00 a ton, whereas the same cities could have purchased crushed stone from commercial plants as low as $1.25 a ton.

Average value per ton of crushed stone produced by commercial and non-commercial operations in the United States, 1933-42

Year	Average value per ton		Year	Average value per ton	
	Commercial operations	Noncommercial operations		Commercial operations	Noncommercial operations
1933	$0.84	$0.95	1938	$0.88	$1.04
1934	.94	.91	1939	.86	.97
1935	.90	.87	1940	.87	1.02
1936	.93	.95	1941	.91	1.04
1937	.88	1.06	1942	.91	1.05

Crushed stone - Concrete and road metal; railroad ballast

Year	Domestic production				Apparent consumption	
	Short tons	Value			Short tons1/	Index nos. 1935-39, ave. = 100
		Total	Average per ton	Price index nos. 1935-39, ave. = 100		
1910	46,308,672	$27,264,535	$0.59	64	46,308,672	54
1911	47,866,937	28,426,375	.59	64	47,866,937	56
1912	48,502,501	28,592,536	.59	64	48,502,501	57
1913	52,318,965	31,677,871	.61	66	52,318,965	61
1914	49,364,476	30,161,766	.61	66	49,364,476	58
1915	49,008,709	29,173,488	.60	65	49,008,709	57
1916	48,075,581	29,462,552	.61	66	48,075,581	56
1917	40,285,377	29,065,509	.72	78	40,285,377	47
1918	29,373,342	27,951,393	.95	103	29,373,342	34
1919	33,673,339	36,405,186	1.08	117	33,673,339	39
1920	40,365,860	50,846,693	1.26	137	40,365,860	47
1921	43,202,840	51,717,478	1.20	130	43,202,840	50
1922	49,763,740	54,130,177	1.09	118	49,763,740	58
1923	62,322,710	67,928,651	1.09	118	62,322,710	73
1924	68,198,440	73,861,576	1.08	117	68,198,440	79
1925	75,672,930	80,508,429	1.06	115	75,672,930	88
1926	82,515,560	87,872,014	1.06	115	82,515,560	96
1927	94,948,770	97,474,267	1.03	112	94,948,770	111
1928	91,265,360	94,186,259	1.03	112	91,265,360	106
1929	92,721,260	94,387,878	1.02	111	92,721,260	108
1930	87,110,890	87,554,354	1.01	110	87,110,890	102
1931	72,624,410	70,404,964	.97	105	72,624,410	85
1932	51,995,100	46,891,765	.90	98	51,995,100	61
1933	45,490,610	39,018,736	.86	93	45,490,610	53
1934	60,567,920	56,466,607	.93	101	60,567,920	71
1935	54,754,520	48,899,982	.89	97	54,754,520	64
1936	87,270,820	82,117,787	.94	102	87,270,820	102
1937	88,432,570	82,824,608	.94	102	88,432,570	103
1938	94,763,050	88,767,221	.94	102	94,763,050	110
1939	103,891,020	93,958,275	.90	98	103,891,020	121
1940	100,268,390	91,563,088	.91	99	100,268,390	117
1941	120,963,910	114,522,259	.95	103	120,963,910	141
1942	125,267,650	116,394,778	.93	101	125,267,650	146

1/ As imports and exports are negligible, consumption is virtually equivalent to production.

SAND AND GRAVEL

Consumption. - In early years large quantities of sand and gravel were produced for road construction and building purposes in haphazard fashion, largely in agricultural communities. The later era of highway construction demanded large quantities of raw materials purchased under increasingly rigid specifications, and sand and gravel production became more generally an organized industry having more or less efficient equipment and methods. This movement was accentuated by the even more rigid specifications established by glassmakers, foundrymen, and other users of industrial sands. Consumption increased more than fourfold during the 33-year period under consideration, and requirements for 1942 exceeded 300 million tons. The large increases since the beginning of the present war are due to growing demands for molding, furnace, and other sands used in munition manufacture, to more thorough ballasting of railroads to sustain heavy transportation, but chiefly to the unprecedented demand for aggregates to be used in concrete construction, which has been discussed in the section devoted to cement.

Prices. - Average prices of sand and gravel fluctuate considerably from year to year, but the changes during recent years are more apparent than real, because the average figures are a composite of commercial and noncommercial production. Noncommercial production - that reported by State highway departments, counties, municipalities, and other Government agencies - attained increasing importance from the early 1930's when the Government took active steps to relieve unemployment. From 1932 to 1940 it constituted 30 to 40 percent of total production. Much of the material so produced was paving sand and gravel, used with little or no preparation. Furthermore, the organizations producing it were non-profit-making, had no taxes to pay, and made little or no provision for amortization of property or equipment. For these reasons the average value of noncommercial production per ton was always much lower than that of the commercial output, and whenever the noncommercial constituted a large share of the total it tended to depress the average realization per ton. Therefore, the value-per-ton figures in the sand and gravel table do not reflect adequately the trend in prices of the commercial output. For instance, the increase in price from 51 to 62 cents a ton from 1941 to 1942 is explained chiefly by the fact that noncommercial production, which was 37 percent of the total in 1941, dropped to only 23 percent in 1942. The accompanying table of prices for these two types of operations during the era of heavy noncommercial activity indicates the low level of noncommercial prices and the striking uniformity of commercial prices from year to year until 1942 when a definite upward trend was apparent.

Average value per ton of sand and gravel produced by commercial and noncommercial operations in the United States, 1931-42

Year	Average value per ton Commercial operations	 Noncommercial operations	Year	Average value per ton Commercial operations	 Noncommercial operations
1931	$0.59	$0.40	1937	$0.63	$0.29
1932	.56	.29	1938	.61	.28
1933	.60	.33	1939	.60	.32
1934	.64	.31	1940	.60	.30
1935	.61	.27	1941	.63	.30
1936	.60	.31	1942	.68	.41

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Sand and gravel

Year	Domestic production				Net imports (short tons)	Apparent consumption	
	Short tons	Value				Short tons	Index nos. 1935-39, ave. = 100
		Total	Average per ton	Price index nos. 1935-39, ave. = 100			
1910	69,410,436	$21,037,630	$0.30	61	1/	69,410,436	39
1911	66,846,959	21,158,583	.32	65	1/	66,846,959	37
1912	68,354,561	23,113,208	.34	69	1/	68,354,561	38
1913	79,555,849	24,217,508	.30	61	1/	79,555,849	44
1914	79,281,735	23,846,999	.30	61	1/	79,281,735	44
1915	76,603,303	23,121,617	.30	61	1/	76,603,303	43
1916	89,091,732	29,809,995	.33	67	1/	89,091,732	49
1917	76,419,325	35,296,932	.46	94	1/	76,419,325	42
1918	61,824,426	37,927,079	.61	124	2/284,036	62,108,462	34
1919	70,576,407	45,951,556	.65	133	597,481	71,173,888	39
1920	82,041,388	65,661,605	.80	163	1,226,684	83,268,072	46
1921	79,845,008	56,484,245	.71	145	906,905	80,751,913	45
1922	94,867,046	64,617,664	.68	139	95,423	94,962,469	53
1923	139,932,153	90,903,654	.65	133	3/ 73,471	139,858,682	78
1924	156,230,063	97,013,115	.62	127	387,270	156,617,333	87
1925	172,001,473	107,542,123	.63	129	108,943	172,110,416	96
1926	183,100,818	111,338,701	.61	124	523,205	183,624,023	102
1927	197,454,269	115,529,786	.59	120	315,028	197,769,297	110
1928	209,118,868	119,207,937	.57	116	50,854	209,169,722	116
1929	222,571,905	132,835,979	.60	122	1,180,009	223,751,914	124
1930	197,051,726	115,176,543	.58	118	1,509,760	198,561,486	110
1931	153,479,044	86,280,320	.56	114	202,851	153,681,895	85
1932	120,037,897	57,522,076	.48	98	116,443	120,154,340	67
1933	107,755,349	53,072,910	.49	100	38,113	107,793,462	60
1934	116,611,689	61,247,173	.53	108	101,740	116,713,429	65
1935	123,923,923	61,977,379	.50	102	132,312	124,056,235	69

See footnotes on page 13.

Sand and gravel (Cont'd.)

Year	Domestic production				Net imports (short tons)	Apparent consumption	
	Short tons	Value				Short tons	Index nos. 1935-39, ave. = 100
		Total	Average per ton	Price index nos. 1935-39, ave. = 100			
1936	178,329,814	$90,307,752	$0.51	104	328,449	178,658,263	99
1937	189,660,423	97,472,997	.51	104	466,489	190,126,912	105
1938	181,320,233	85,922,847	.47	96	665,404	181,985,637	101
1939	226,008,000	106,066,000	.47	96	4/248,197	226,256,197	126
1940	238,308,000	110,688,000	.46	94	5/444,065	238,752,065	132
1941	288,715,000	147,207,000	.51	104	6/264,976	7/288,979,976	160
1942	304,346,000	188,500,000	.62	127	(8/)	9/304,346,000	169

1/ Data not available. Quantities for imports not recorded before July 1918, and for exports not recorded before January 1922.

2/ July 1 to December 31.

3/ Net exports.

4/ Exports classed as "Gravel and building stone."

5/ No data available on exports subsequent to 1939.

6/ January to September, inclusive.

7/ Includes imports for the first 9 months only.

8/ Data not available.

9/ Domestic production. Data on imports and exports not available.

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BUILDING STONE

Consumption. - Building stone, like roofing slate, has experienced a severe decline during recent years. Estimated consumption in 1910 was 2-1/2 times as great as the average of the years 1935 to 1939. From 1910 to 1931, except for a 4-year period (1917 to 1920) during and immediately after the World War of 1914-18, building stone was used extensively, consumption reaching a maximum of nearly 35,000,000 cubic feet in 1929. During the depression years consumption dropped to low levels, but this condition was common to most mineral commodities. However while many products staged a strong post-depression recovery building stone failed to respond to renewed building activity.

Several factors contribute to this continued depression. One element is the wider use of architectural concrete products as substitutes for stone. Another is the reinforced-concrete method of construction now widely used in large buildings. In early days many load-bearing walls consisted of massive stone masonry 2 to 6 feet in thickness, but the so-called stone building of today has reinforced-concrete walls with a facing of stone that may be in blocks not more than 4 inches thick. Thus a modern stone building contains comparatively little stone. Many fine residences built 30 or 40 years ago had cut-stone base courses, stone steps and areaways, and stone windowsills and trim. Very little cut stone is now used in residences, although seamfaced granite and other forms of rough stone veneer are used extensively in some localities.

Some factors contributing to a reduced demand for stone date back many years before the peak consumption in the late 1920's, but during that period the retarding influences were more than compensated by extensive public building programs. Construction of innumerable stone-faced Government buildings, churches, museums, college buildings, stores, and office buildings during the prosperous era that reached its high point in 1929 created a record demand that subsided speedily as these projects were completed and few new ones were begun.

The year 1942 was the worst in the recorded history of the building-stone industry. Consumption was less than one-fifth of that in 1929. This condition was of course to be expected because the war program demanded cessation of all construction of edifices that ordinarily employ stone as a major building material.

An era of public building construction will undoubtedly return; but, although natural stone is among the most dignified, permanent, and beautiful of all building materials, the extent to which it will regain its former prominence is problematical. Prefabricated structural units and synthetic building materials are growing in popularity. They can be manufactured by mass production methods and can be speedily erected at relatively low cost, whereas natural stone requires careful selection and laborious processes of quarrying and manufacture. Future prosperity will depend largely upon development of economies in fabrication and on the successful outcome of efforts directed toward establishing wider recognition of the superior qualities of stone.

Prices. - The average selling value of building stone per cubic foot has not varied greatly, although prices were generally higher during the more prosperous years. The average value per cubic foot given in the accompanying table is a composite of the values of a series of commodities ranging from rough construction stone to carved and polished products. Consequently the fluctuations from year to year may be due in part to variation in the proportions of high-priced and low-priced products and therefore may have little significance from the standpoint of trends in sale prices. The general trend from heavy masonry to thin veneer undoubtedly resulted in a higher unit value of cut stone because of increased fabrication costs, but on the other hand the movement toward stone veneer has brought about a lower expense for stone per square foot of wall area. It is difficult to reduce the production cost of building stone, and, as it enters a highly competitive market, it is evident that prices are stabilized at levels only moderately higher than over-all production costs.

Building stone (rough and dressed)

Year	Domestic production				Imports1/ (cubic feet)	Apparent consumption	
	Cubic feet	Value				Cubic feet	Index nos. 1935-39, ave. = 100
		Total	Average per cubic foot	Price index nos. 1935-39, ave. = 100			
1910	2/27,800,000	$16,105,856	$0.58	66	(3/)	27,800,000	205
1911	2/27,900,000	16,443,758	.59	67	(3/)	27,900,000	206
1912	2/21,200,000	16,306,659	.77	88	(3/)	21,200,000	156
1913	2/21,000,000	18,097,219	.86	98	(3/)	21,000,000	155
1914	2/19,300,000	17,796,552	.92	105	(3/)	19,300,000	142
1915	2/18,300,000	15,380,448	.84	95	(3/)	18,300,000	135
1916	25,060,040	14,677,808	.59	67	(3/)	25,060,040	185
1917	17,467,920	12,102,914	.69	78	(3/)	17,467,920	129
1918	8,616,900	7,454,973	.87	99	(3/)	8,616,900	63
1919	12,764,516	10,613,683	.83	94	(3/)	12,764,516	94
1920	15,870,530	18,948,588	1.19	135	(3/)	15,870,530	117
1921	17,006,210	18,975,819	1.12	127	(3/)	17,006,210	125
1922	24,262,250	25,749,398	1.06	120	(3/)	24,262,250	179
1923	26,417,020	32,022,717	1.21	138	(3/)	26,417,020	195
1924	28,352,380	33,175,656	1.17	133	(3/)	28,352,380	209
1925	30,695,310	35,444,809	1.15	134	(3/)	30,695,310	226
1926	33,467,420	39,922,851	1.19	135	(3/)	33,467,420	247
1927	32,104,200	40,595,127	1.26	144	(3/)	32,104,200	237
1928	30,795,530	42,769,904	1.39	158	(3/)	30,795,530	227
1929	34,761,140	43,905,123	1.26	143	(3/)	34,761,140	256
1930	30,169,270	39,111,527	1.30	148	4/74,163	30,243,433	223
1931	21,461,440	28,111,058	1.31	149	85,500	21,546,940	159
1932	16,624,000	20,184,566	1.21	138	37,706	16,661,706	123
1933	11,512,490	15,337,939	1.33	151	13,574	11,526,064	85
1934	9,026,270	8,538,847	.95	108	5,056	9,031,326	67

See footnotes on page 17.

Building stone (rough and dressed) (Cont'd.)

Year	Domestic production				Imports1/ (cubic feet)	Apparent consumption	
	Cubic feet	Value				Cubic feet	Index nos. 1935-39, ave. = 100
		Total	Average per cubic foot	Price index nos. 1935-39, ave. = 100			
1935	10,548,740	$6,755,445	$0.64	73	17,763	10,566,503	78
1936	12,727,290	12,585,644	.99	113	48,917	12,776,207	94
1937	14,685,020	13,142,674	.89	101	13,404	14,698,424	108
1938	12,777,780	11,894,560	.93	106	29,641	12,807,421	94
1939	16,980,660	16,008,285	.94	107	28,946	17,009,606	125
1940	10,642,690	11,500,699	1.08	123	21,657	10,664,347	79
1941	10,332,860	9,817,967	.95	108	5/1,995	6/10,334,855	76
1942	6,444,250	5,926,161	.92	105	(7/)	8/ 6,444,250	47

1/ Exports negligible.
2/ Estimates based on partial returns of quantities sold.
3/ Separate data for imports of building stone not available. Imports have always been relatively small; furthermore, except for the travertine, figures for which are included in this column for 1930-41, most of the dimension stone imported has been applied to monumental and ornamental rather than to building uses. Imports from 1910-29 may therefore be disregarded.
4/ June 18 to December 31.
5/ January to September, inclusive.
6/ Includes imports for the first 9 months only.
7/ Data not available.
8/ Domestic production. Data on imports not available.

ROOFING SLATE

Consumption. - Consumption of roofing slate, like that of building stone, declined seriously during the past third of a century. Average annual consumption for the period 1936 to 1941 was only about 30 percent of that for 1910. Reasons for the inability of slate to maintain a consumption level approaching the one of many years ago were analyzed in a previous report.[6] The chief reason is competition with lower-cost roofing materials. It is difficult to reduce the relatively high cost of roofing slate because defects and variations in quality result in a heavy percentage of waste and because slate is not adapted to mechanized mass production. Processes of manufacture have changed very little during the past 100 years. Furthermore, slate is a heavier product than most of its competitors and therefore has to bear the burden of higher freight charges. Slate setting is an art that demands considerable skill, which tends to increase the cost of the finished roof. Consumption since 1925 would doubtless have been even lower were it not for an improved cutting machine, the wire saw, introduced in this country by the Bureau of Mines in 1926 and adopted generally throughout the Pennsylvania slate district. This mechanism reduced waste very greatly and also substantially reduced the cost of producing quarry blocks. The drastic decline in consumption in 1942 was not unexpected in view of the recessions in private building and the lack of demand for slate in the types of military construction that constituted the great bulk of building activity in that year.

A recently developed improved method of placing slate on roofs promises to reduce the weight of slate per square to about one-half of that formerly required, as well as to cut the cost of each square of finished roof about 50 percent. Wide acceptance of this method, plus more general recognition of the enduring and esthetic qualities of slate, may tend to expand future market demands.

The potential market for roofing slate is very great. A survey of roofs in the South Central States made by the National Bureau of Standards in 1942 shows that only three-fourths of 1 percent of all rural dwellings in that area are covered with slate roofs, whereas in England it has been estimated that 40 percent of such dwellings have slate roofs.

Prices. - Unit prices of roofing slate were very low before the first World War. The relatively high prices that have prevailed since 1922 in a highly competitive market reflect in part the high cost of production already discussed and in part the growing sales of the large, heavy "architectural" varieties the cost of which is always much higher than that of the standard types.

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[6] Bowles, Oliver, Consumption Trends in the Roofing Slate Industry: Bureau of Mines Rept. of Investigations 3221, 1933, 3 pp.

Roofing slate

Year	Domestic production				Net exports (squares)	Apparent consumption	
	Squares (100 square feet)	Value				Squares	Index nos. 1935-39, ave. = 100
		Total	Average per square	Price index nos. 1935-39, ave. = 100			
1910	1,260,621	$4,844,664	$3.84	54	(1/)	1,260,621	377
1911	1,124,677	4,348,571	3.87	55	(1/)	1,124,677	336
1912	1,197,288	4,636,185	3.87	55	(1/)	1,197,288	358
1913	1,113,944	4,461,062	4.00	57	2/56,603	1,057,341	316
1914	1,019,553	4,160,832	4.08	58	2/34,099	985,454	295
1915	967,880	3,746,334	3.87	55	2/11,922	955,958	286
1916	835,873	3,408,934	4.08	58	2/ 6,772	829,101	248
1917	703,667	3,411,740	4.85	69	2/ 5,590	698,077	209
1918	379,817	2,219,131	5.84	83	2/11,168	368,649	110
1919	454,337	3,085,957	6.79	96	2/ 8,124	446,213	133
1920	396,230	3,524,658	8.90	126	2/13,720	382,510	114
1921	348,085	3,197,745	9.19	130	2/11,059	337,026	101
1922	479,243	4,069,761	8.49	120	11,040	468,203	140
1923	507,587	4,582,535	9.03	128	8,462	499,125	149
1924	469,393	4,626,614	9.86	140	8,165	461,228	138
1925	494,530	5,084,945	10.28	146	5,785	488,745	146
1926	465,900	5,079,087	10.90	154	5,621	460,279	138
1927	468,560	4,949,940	10.56	150	6,798	461,762	138
1928	483,280	5,411,332	11.20	159	2/10,627	472,653	141
1929	462,120	4,920,766	10.65	151	2/ 9,157	452,963	136
1930	340,140	3,359,939	9.88	140	2/ 4,608	335,532	100
1931	277,700	2,364,861	8.52	121	3,220	274,480	82
1932	144,410	1,072,255	7.43	105	1,030	143,380	43
1933	153,170	967,834	6.32	90	1,155	152,015	45
1934	137,010	1,033,164	7.54	107	2/ 1,128	135,882	41
1935	221,630	1,456,041	6.57	93	2/ 1,390	220,240	66
1936	366,130	2,607,402	7.12	101	(1/)	366,130	110
1937	365,800	2,728,109	7.46	106	1,025	364,775	109
1938	322,040	2,247,910	6.98	99	660	321,380	96
1939	399,320	2,868,961	7.18	102	569	398,751	119
1940	347,130	2,436,123	7.02	99	475	346,655	104
1941	378,980	3,180,766	8.39	119	(1/)	378,980	113
1942	192,070	1,704,053	8.87	126	(1/)	192,070	57

1/ Data not available.
2/ Approximate.

BUILDING LIME

Consumption. - The course of building lime has followed the general pattern of the "durable goods" industries to which building construction belongs. Lime was an important building material for many years before the World War of 1914-18; and, except for a marked recession in 1918, pre-war consumption levels were maintained with only moderate fluctuations until 1922, when a strong upward trend began, culminating in an all-time high of nearly 2,400,000 tons in 1925. A marked decline in the demand for building lime started in 1926, 2 years before the onset of the great slump in building construction. This premature recession is to be attributed to some extent to competition with other cementitious materials. Building lime followed the downward course of other building materials through the depths of the depression; and, although it regained some ground thereafter, consumption remained far below the levels of the predepression years. Demands were exceptionally low in 1942, because multitudes of buildings erected in that year were of temporary types in which little plaster or mortar was used.

Prices. - Before the World War of 1914-18 the average unit value of building lime at the producers' plant was $4.20 to $4.50 a ton - about one-half the present-day value. Prices rose steadily after 1915, and remained in the neighborhood of $10 a ton from 1919 to 1927. The subsequent sudden drop in demand was accompanied by a substantial decrease in price, which probably reflected in some degree the growing competition with other products. Prices from 1934 to 1942 have remained remarkably constant.

Lime (building)

Year	Domestic production				Apparent consumption	
	Short tons	Value			Short tons[1]	Index nos. 1935-39, ave. = 100
		Total	Average per ton	Price index nos. 1935-39, ave. = 100		
1910	1,746,662	$7,526,914	$4.31	50	1,746,662	201
1911	1,488,567	6,755,889	4.54	53	1,488,567	171
1912	1,556,446	6,571,479	4.22	49	1,556,446	179
1913	1,358,099	6,011,856	4.43	52	1,358,099	156
1914	1,163,433	5,068,375	4.36	51	1,163,433	134
1915	1,149,733	4,896,990	4.26	50	1,149,733	132
1916	1,509,968	7,859,614	5.21	61	1,509,968	173
1917	1,313,493	8,713,845	6.63	77	1,313,493	151
1918	914,186	7,781,388	8.51	99	914,186	105
1919	1,191,434	11,484,318	9.64	113	1,191,434	137
1920	1,305,412	15,269,683	11.70	137	1,305,412	150
1921	1,239,486	13,258,443	10.70	125	1,239,486	142
1922	1,845,208	18,463,825	10.01	117	1,845,208	212
1923	2,131,533	22,521,638	10.57	123	2,131,533	245
1924	2,169,700	23,011,935	10.61	124	2,169,700	249
1925	2,387,267	24,115,420	10.10	118	2,387,267	274
1926	2,320,323	23,227,034	10.01	117	2,320,323	267
1927	2,148,840	20,962,759	9.76	114	2,148,840	247
1928	1,986,465	17,706,420	8.91	104	1,986,465	228
1929	1,640,827	14,303,539	8.72	102	1,640,827	189
1930	1,204,614	10,050,270	8.34	97	1,204,614	138
1931	947,085	6,940,250	7.33	86	947,085	109
1932	596,825	3,850,950	6.45	75	596,825	69
1933	533,088	3,828,594	7.18	84	533,088	61
1934	511,419	4,260,865	8.33	97	511,419	59
1935	656,894	5,716,802	8.70	102	656,894	75
1936	891,267	7,589,346	8.52	100	891,267	102
1937	948,553	8,212,995	8.66	101	948,553	109
1938	854,461	7,163,165	8.38	98	854,461	98
1939	1,000,498	8,563,792	8.56	100	1,000,498	115
1940	1,010,435	8,542,207	8.45	99	1,010,435	116
1941	1,065,599	9,259,118	8.69	102	1,065,599	122
1942	697,677	6,173,205	8.85	103	697,677	80

1/ As imports and exports are negligible, consumption is virtually equivalent to production.

GYPSUM

Consumption. - Activity in the gypsum industry is closely allied to the volume of building construction because its products are principally building materials. Even cement retarder, which constitutes a substantial tonnage and is not classed primarily as a building material, fluctuates in demand in accordance with cement output, and cement is preeminently a material of construction.

Consumption of gypsum remained remarkably constant from 1910 through the first World War until 1920, when a marked increase in demand was in evidence. During the era of extensive building construction from 1923 to 1929, annual consumption more than doubled that of the 1910-19 decade. Like all building materials, gypsum products experienced a severe slump during the depression period from 1930 to 1935. The moderate gains of 1936 to 1939 were accelerated as the war clouds gathered, and when cantonment and other military construction began on a large scale the demands increased greatly. Gypsum board is well-adapted for rapid, economical construction and therefore was used extensively where more or less temporary buildings were needed within a limited time. Consumption reached an all-time high in 1942. The rapid increase in use of gypsum products during recent years is to be attributed in part to the development of new or improved products such as gypsum lath, a building material that has made phenomenal gains in sales since 1933.

Prices. - Prices of crude gypsum are somewhat hypothetical, as run-of-mine material is not bought and sold in the open market. The average values listed in the table for 1937 to 1942 are based on producers' estimates. which may represent only the actual cost of mining (including depreciation, depletion, etc.) or may represent a probable open-market price. As the figures given are based on studied estimates by many producers, they probably reflect actual values with fair accuracy. The average ratio of the reported value of crude run-of-mine to that of cement retarder for 1937 to 1942 is 77 percent. As producers' estimates of crude gypsum values are not available for the years before 1937, average values per ton for these years have been calculated as being 77 percent of the average reported sales values per ton of retarder.

Prices were relatively high from 1918 to 1927, but since 1927 they have maintained an average only two-thirds as high as during that period. As both materials and wages have been much higher during recent years than in the earlier period, the recent low unit value may reflect greater efficiency of mining and increased output per man-hour.

Gypsum (crude)

Year	Domestic production				Imports[3/] (short tons)	Apparent consumption	
	Short tons	Value				Short tons	Index nos. 1935-39, ave. = 100
		Total[1/]	Average per ton[2/]	Price index nos. 1935-39, ave. = 100			
1910	2,379,057	$2,854,868	$1.20	82	415,321	2,794,378	79
1911	2,323,970	2,649,326	1.14	78	389,874	2,713,844	77
1912	2,500,757	2,550,772	1.02	70	412,697	2,913,454	82
1913	2,599,508	2,937,444	1.13	77	447,383	3,046,891	86
1914	2,476,465	2,699,347	1.09	75	369,214	2,845,679	80
1915	2,447,611	2,447,611	1.00	68	336,856	2,784,467	79
1916	2,757,730	2,840,462	1.03	71	254,131	3,011,861	85
1917	2,696,226	3,424,207	1.27	87	240,269	2,936,495	83
1918	2,057,015	3,826,048	1.86	127	50,653	2,107,668	60
1919	2,420,163	5,275,955	2.18	149	171,733	2,591,896	73
1920	3.129,142	8,636,432	2.76	189	282,486	3,411,628	96
1921	2,890,784	7,342,591	2.54	174	266,796	3,157,580	89
1922	3,779,949	8,920,680	2.36	162	409,475	4,189,424	118
1923	4,753,448	10,790,327	2.27	155	448,129	5,201,577	147
1924	5,042,629	10,337,389	2.05	140	519,627	5,562,256	157
1925	5,678,302	11,640,519	2.05	140	634,423	6,312,725	178
1926	5,635,441	10,876,401	1.93	132	824,081	6,459,522	182
1927	5,346,888	9,945,812	1.86	127	828,619	6,175,507	174
1928	5,102,250	7,296,218	1.43	98	1,028,816	6,131,066	173
1929	5,016,132	7,273,391	1.45	99	1,036,385	6,052,517	171
1930	3,471,393	4,825,236	1.39	95	902,358	4,373,751	123
1931	2,559,017	3,761,755	1.47	101	713,880	3,272,897	92
1932	1,416,274	2,124,411	1.50	103	374,072	1,790,346	51
1933	1,335,192	1,815,861	1.36	93	359,490	1,694,682	48
1934	1,536,170	2,073,830	1.35	92	360,186	1,896,356	54
1935	1,903,880	2,627,354	1.38	95	450,250	2,354,130	66

See footnotes on page 24.

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Gypsum (crude) (Cont'd.)

Year	Domestic production				Imports3/ (short tons)	Apparent consumption	
	Short tons	Value				Short tons	Index nos. 1935-39, ave. = 100
		Total1/	Average per ton2/	Price index nos. 1935-39, ave. = 100			
1936	2,712,510	$3,780,389	$1.39	95	676,990	3,389,500	96
1937	3,058,166	4,770,739	1.56	107	897,484	3,955,650	112
1938	2,684,205	4,267,886	1.59	109	789,429	3,473,634	98
1939	3,226,737	4,420,630	1.37	94	1,308,078	4,534,815	128
1940	3,699,015	5,215,611	1.41	97	1,405,210	5,104,225	144
1941	4,788,534	6,799,718	1.42	97	4/868,234	5/5,656,768	160
1942	4,697,568	6,811,474	1.45	99	(6/)	7/4,697,568	133

1/ Calculated from estimated average value per ton.

2/ Figures for 1937 to 1942 are averages of reported estimates by gypsum producers for run-of-mine crude gypsum. Figures for 1910 to 1936 are 77 percent of reported value per ton of retarder. (See text.)

3/ Exports negligible.

4/ January to September, inclusive.

5/ Includes imports for the first 9 months only.

6/ Data not available.

7/ Domestic production. Data on imports not available.

Original from THE OHIO STATE UNIVERSITY